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ABSTRACT

Presented is a reading-discussion, activities-experiences course with group and individual projects and experiments especially recommended for students interested in ecology and/or related sciences. Special emphasis is placed on Marine Science. Several texts, including Rachel Carson's "The Edge of the Sea," "The Sea Around Us," and "Under the Sea Wind," are listed as possible texts. Fifteen performance objectives are included to accompany a course outline with eight major topics: (1) Physical Factors in the Marine Environment; (2) Chemical Factors; (3) Geological Factors; (4) Biological Factors; (5) Ocean Engineering; (6) Marine Resources; (7) Air-Sea Interaction; and (8) A Career in Oceanography. Sixteen experiments, drawn from Florida's State Department of Education publication "The Source Book of Marine Sciences," are suggested as valuable student-learning experiences. Demonstrations by the teacher are also suggested. Student projects and reports are encouraged. Suggested topics are listed and audio-visual instructional aids are suggested. A master sheet coordinates each objective with respective texts, lab experiences, projects, reports, films, discussion questions and other learning activities. (Author/EB)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE **QUINMESTER PROGRAM**

ADVENTURES IN ECOLOGICAL READING

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SCIENCE

5114.85
5115.85
5116.85

LANGUAGE ARTS

(Experimental)

DIVISION OF INSTRUCTION • 1971

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Written by Charlotta B. Mary
for the
DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Florida
1972

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TABLE OF CONTENTS

	<u>Page</u>
Course Description	1
Enrollment Guidelines	1
Texts	1
Performance Objectives	2
Course Outline	3
Experiments	7
Demonstrations	8
Projects	8
Reports	9
Field Trips	10
Related Problems	11
Films	11
Models	14
Overhead Transparencies	14
Filmstrips	15
Discussion Questions	16
References	17
Master Sheet	19

COURSE DESCRIPTION

A reading-discussion, activities-experiences course with group and individual projects and experiments.

ENROLLMENT GUIDELINES

This course is an elective offering as well as one which is suggested for the student who plans to continue in this area.

TEXTS

1. Carson, Rachel. The Edge of the Sea. New York: New American Library, Inc., 1955.
2. Carson, Rachel. The Sea Around Us. New York: New American Library Inc., 1961.
3. Carson, Rachel. Under the Sea Wind. New York: New American Library, Inc., 1941.
4. Reid, George. The Intertidal Zone. St. Petersburg; Florida Presbyterian College, 1967.
5. Scheffer, Victor B. The Year of the Whale. New York: Charles Scribner's Sons, 1969.
6. Zim, Herbert S. and Ingle, Lester. Seashores. New York: Golden Press, 1955.

PERFORMANCE OBJECTIVES

1. The student will explain the tides in relation to the forces of the sun and the moon.
2. The student will differentiate between the following kinds of waves: (1) progressive; (2) standing; (3) wind; (4) seismic; and (5) submarine.
3. The student will list those forces that are of critical importance in producing both submarine and surface ocean currents.
4. The student will relate light intensity findings to size and distribution of specified populations in the marine environment.
5. The student will distinguish between the following chemical factors in the marine environment: (1) sea-water components; (2) suspended solids; (3) sub-reservoirs; (4) residence time; (5) dissolved components; (6) sediments; (7) density; and (8) temperature.
6. The student will describe the following factors of the ocean floor: (1) continental shelf; (2) continental slope; (3) deep ocean basins; (4) mid-ocean ridges; (5) seamounts; (6) guyots; (7) scarps; and (8) plateaus.
7. Given a description of a simplified process or situation, the student will correctly choose the term applied to each from the following list: (1) food chain; (2) food web; (3) energy flow; (4) mineral cycle; (5) atmosphere cycle; (6) succession; (7) community; (8) limiting factors; (9) territory; (10) microclimate; and (11) oceanic mixing.
8. The student will graphically analyze the following: (1) salinity versus depth; (2) flora versus depth; (3) fauna versus depth; (4) temperature versus depth; and (5) salinity versus density.
9. The student will conduct an in-depth study of a salt marsh and a seashore.
10. The student will demonstrate graphically the sea-air interaction relationship as follows: (1) the hydrologic cycle; (2) the wind-wave, wind-current picture; (3) the heat engine theory; (4) the geographic distribution of biological systems; and (5) the ocean-atmosphere-carbon-dioxide balance.

PERFORMANCE OBJECTIVES (Continued)

11. The student will research the topic of ocean engineering to determine:
(1) need for ocean engineering; (2) means by which ocean engineers gain knowledge; (3) ways ocean engineers use knowledge; and (4) the uses of the sea.
12. On a Mercator Projection of the earth, the student will make in symbols and show by legend the following marine resource locations:
(1) food plants in the sea; (2) fuels; (3) diamonds; (4) mineral nodules; (5) desalting stations; (6) major fishing areas; and (7) kinds of fishes taken.
13. The student will construct a typical food chain involving four trophic levels (finding levels of consumer and consumed) of organisms found by him in the intertidal zones.
14. The student will identify and carry on an in-depth study of the representative animals of the open seas.
15. The student will investigate the following concerning careers in oceanography: (1) work of the oceanographer; (2) science of oceanography; and (3) demand for oceanographers.

COURSE OUTLINE

I. Physical Factors In the Marine Environment

A. Wind

1. Sea-air interaction
2. Wind-current interaction
3. Wind-weather interaction

B. Waves

1. Progressive
2. Standing
3. Wind waves

a. Sea

b. Swell

COURSE OUTLINE (Continued)

4. Seismic

5. Submarine

C. Currents

1. Causes of currents

a. Coriolis force

b. Density differences

c. Ekman-layer

d. Thermohaline circulation

2. Kinds of currents

a. Polar

b. Equatorial

3. Locations of major currents

4. Movements of major currents

D. Tides

E. Light

F. Density

G. Temperature

II. Chemical Factors in the Marine Environment

A. Sea water components

1. Dissolved constituents

a. Salts

b. Elements

2. Suspended solids

COURSE OUTLINE (Continued)

- 3. Sub-reservoirs
- 4. Residence time
- B. Sediments
 - 1. Organic
 - 2. Inorganic
- III. Geological Factors in the Marine Environment
 - A. Divisions of the ocean floor
 - 1. Continental shelf
 - 2. Continental slope
 - 3. Deep ocean basins
 - B. Topology of the ocean floor
 - 1. Mid-ocean ridges
 - 2. Seamounts
 - a. Atolls
 - b. Tablemounts (guyots)
 - 3. Scarps
 - 4. Plateaus
 - C. Composition of the ocean floor
 - D. Turbidity currents of the ocean floor
- IV. Biological Factors in the Marine Environment
 - A. Major communities of marine life
 - 1. The intertidal zone
 - a. Food chains
 - b. Food webs

COURSE OUTLINE (Continued)

- 2. Shallow seas
- 3. Open seas
- B. Zonation in the sea
- C. Representative animals of the open seas
 - 1. Whales
 - 2. Sharks
 - 3. Fishes
- V. Ocean Engineering
 - A. Need for oceanic knowledge
 - B. Means of gathering knowledge
 - C. Ways knowledge is useful
- VI. Marine Resources
 - A. Uses of the sea
 - B. Resources
- VII. Air-Sea Interaction
 - A. Hydrologic cycle
 - B. Carbon dioxide cycle
 - C. The heat engine
 - D. Other considerations
- VIII. A Career In Oceanography
 - A. What does the oceanographer do?
 - B. What kind of science is oceanography?
 - C. What is the demand for oceanographers?

EXPERIMENTS

State Department of Education. The Source Book of Marine Sciences.
Tallahassee: 1968.

1. Salt-Water Aquaria for the Laboratory Classroom. (Exp. 1, p. 1)
2. Using the 24 Hour Clock. (Exp. 2, p. 9)
3. The General Nature of the Tides, Including Instructions in the Use of Tide Tables. (Exp. 3, p. 11)
4. Charting Local Current Systems. (Exp. 4, p. 15)
5. Turbidity. (Exp. 7, p. 29)
6. pH Determination of Sea Water. (Exp. 9, p. 25)
7. The Taxonomy of Marine Animals. (Exp. 15, p. 57)
8. Plankton. (Exp. 16, p. 63)
9. The Living World Within a Sponge. (Exp. 17, p. 73)
10. Horseshoe Crab. (Exp. 21, p. 81)
11. Barnacles-Their Habits and Life Histories. (Exp. 23, p. 91)
12. A Statistical Analysis of a Fiddler Crab Colony. (Exp. 26, p. 103)
13. A Shark Study. (Exp. 30, p. 117)
14. Determining the Age of Fishes by Counting Scale Rings. (Exp. 32, p. 127)
15. Evidence of Feeding Habits of Fishes. (Exp. 33, p. 131)
16. Preparation of Herbarium Mounts. (Exp. 39, p. 147)

DEMONSTRATIONS

State Department of Education. The Source Book of Marine Sciences.
Tallahassee: 1968.

1. The Determination of the Salinity of Sea Water (p. 39)
2. Bioluminescence (p. 55)
3. Sponge Spiculation (p. 75)
4. The Pelecypod Gill (p. 79)
5. Sea Urchin Fertilization and Development (p. 109)
6. Light: The Importance of the Study of the Physical and Biological Properties of Light in Ocean Water (p. 135)
7. Analysis of Floating Seaweed Populations (p. 145)

PROJECTS

1. Develop a model of the ocean currents which takes into consideration the following points: (1) kinds; (2) locations; (3) origins; (4) extent; (5) movements; and (6) influence on land masses.
2. Mark the location of the ice caps on the earth and shade in areas of the world that would be flooded if the caps melted.
3. Conduct a survey to determine the uses of the sea.
4. Outline a plan of action concerning: (1) gathering information about careers in oceanography; (2) organizing three minute spot-radio talks.
5. Design and carry out an experimental research project in oceanography, and write up or prepare a display for the Science Fair or the Junior Academy of Science.
6. Make models of three typical seashore communities: (1) rock; (2) sand; (3) mud.

PROJECTS (Continued)

7. Construct posters to illustrate the difference between a Pacific Coast protected tide pool and the clam-rich mud flats of Long Island.
8. Prepare a "family tree" to illustrate that the animals of the sea and land are one in the general picture of their relationship.
9. Collect, mount and label correctly seaweeds (marine algae) found off the shores of the Dade County area.
10. Chronicle the life of the great blue whale from birth to its final resting place; chart the whales' journeys; identify its food; list its enemies and its friends; and compare its physiology to that of man.

REPORTS

1. Characterizing himself as a whale, the student will write a short science fiction story expressing life under the sea.
2. Following library research, the student will prepare charts showing the kinds of animals that exhibit bioluminescence.
3. The student will investigate sharks as to: (1) taxonomy; (2) feeding habits; (3) the shark as a laboratory research animal; (4) their commercial value.
4. Using reference materials, the student will write a brief summary concerning the general topology of the ocean floor.
5. The student will write an essay that lists five changes that occur in the intertidal populations during the neap tides and the spring tides, and explains his interpretations of zonal diversity.
6. The student will apply research skills to isolate those animals and plants that exhibit internal biological clocks.
7. The student will present an illustrated report embracing the air-sea interaction relationships.

FIELD TRIPS AND RELATED ACTIVITIES

1. Sea-Air Interaction Laboratory on Brickell Avenue. Contact Mr. Feodor Ostapoff.
2. Biscayne Bay, Haulover Beach, Key West and Naples to study range and tidal frequencies.
3. Biscayne Bay to study light intensities at various depths; relationships between light intensities and size and distribution of specified populations in the marine environment; measure turbidity by using a Secchi disc; observe the kinds and depths of sediment on the sea floor.
4. Crandon Park to identify and map the intertidal zones.
5. Collect sea water from McArthur Causeway for chemical analysis.
6. Coastal areas to locate and study the horseshoe crab in its native range.
7. Use a boat to observe the Gulf Stream and obtain plankton samples for observation and study.
8. Crandon Park to collect marine specimens for classification activities.
9. Dodge Island Sea Port to observe barnacles on ocean going vessels and on the docks.
10. Haulover Beach to observe and analyze the fiddler crab colony statistically.
11. Seine fish in Bay area for study of fish scales and teeth.
12. Matheson Hammock to conduct an in-depth study of a salt marsh.

WARNING - BE SURE TO HAVE A COLLECTION PERMIT. WRITE TO:

Florida Board of Conservation
Larson Building
Tallahassee, Florida
(Attention Permit Clerk)

RELATED PROBLEMS (MATH)

1. The student will construct a one-month tidal table for Biscayne Bay.
2. The student will design, build and use his own 24-Hour Clock.
3. The student will compute the size-relationship between the size of a fish scale viewed under a low-power ocular magnification and the actual size of the scale.
4. The student will use bathymetric charts to reproduce graphically the submarine topography of Biscayne Bay and the Gulf of Mexico.
5. The student will prepare a monthly survey chart of the Gulf Streams' positions.

FILMS AVAILABLE FROM DADE COUNTY AUDIOVISUAL CENTER

1. Animals That Live In the Surf
AV # 1-02699, 11 min., C
2. Birds of the Sea
AV # 1-02935, 11 min., C
3. Marine Animals of the Open Coast
AV # 1-11075, 22 min., C
4. Sea Shell Animals
AV # 1-02682, 10 min., C
5. Animals Life at Low Tide
AV # 1-02696, 11 min., C
6. Beach and Sea Animals
AV # 1-02664, 11 min., B/W
7. Between the Tides
AV # 1-11071, 20 min., C
8. Coral Wonderland
AV # 1-30697, 30 min., C
9. Exploring the Ocean
AV # 1-02069, 11 min., C

FILMS AVAILABLE FROM DADE COUNTY AUDIOVISUAL CENTER (Continued)

10. Fish and Their Characteristics
AV # 1-02831, 11 min., C
11. Fish Are Interesting
AV # 1-02828, 10 min., C
12. A Fish Family
AV # 1-02173, 11 min., C
13. Fish, Moon and Tides: The Grunion Story
AV # 1-11173, 15 min., C
14. Fish Out of Water
AV # 1-02835, 11 min., B/W
15. The Great Polar Whale
AV # 1-05093, 10 min., C
16. Life In the Ocean
AV # 1-11043, 18 min., C
17. The Mollusks
AV # 1-11143, 14 min., B/W
18. Seal Island
AV # 1-30689, 27 min., C
19. Secrets Of the Underwater World
AV # 1-11144, 16 min., C
20. Sounds In the Sea
AV # 1-11178, 14 min., C
21. Tigers Of the Sea
AV # 1-03928, 10 min., B/W
22. We Explore the Beach
AV # 1-02205, 10 min., B/W
23. Whales and Whalesmen
AV # 1-11522, 22 min., C
24. Mysteries Of the Deep
AV # 1-31432, 28 min., C

FILMS AVAILABLE FROM DADE COUNTY AUDIOVISUAL CENTER (Continued)

- 25. The Sea
AV # 1-31481, 27 min., C
- 26. The Restless Sea (Part 1)
AV # 1-30369, 30 min., C
- 27. The Restless Sea (Part 2)
AV # 1-30371, 30 min., C

FILMS FROM OUTSIDE DADE COUNTY AVAILABLE ON FREE LOAN

Write to: Commandant
6th Naval District
Assistant for Public Affairs
U. S. Naval Base
Charleston, South Carolina 29408

- 28. Oceanographers In Polar Regions
MN-10301, 28 min., C
- 29. Careers In Oceanography
MN-10063, 28 min., C
- 30. Challenge Of the Sea
MN-10021, 23 min., C
- 31. Mission Oceanography
MN-10145, 30 min., C
- 32. Sealab I
MN-100, 29 min., C
- 33. The Story Of Sealab II
MN-101008, 30 min., C
- 34. The Dolphins That Joined the Navy
MN-10199, 28 min., C

MODELS

1. Animals Of the Sea, Set I
AV # 6-00112, C 24
2. Animals Of the Sea, Set II
AV # 6-00161, C 25
3. Florida Shells, Set 3: Univalves and Bivalves
AV # 6-00159, C 72
4. Florida Shells, Set 2
AV # 6-00052, C 19 (26 pieces)
5. Marine Life
AV # 6-00087, C 18
6. Mollusks Exhibit
AV # 6-00002, C 12
7. Florida Shells, Set 4
AV # 6-00001, 214 pieces

OVERHEAD TRANSPARENCIES

Available from: Life Educational Materials Center
Life Education Program
Box 834, Radio City Post Office
New York, New York 10019

1. First Life In The Sea
EV-10501
2. The Ocean Floors
ES-10514

FILMSTRIPS

Available from: LIFE Education Program
Box 834, Radio City Station
New York, New York 10019

1. Sharks, #313
2. Whales, #328
3. Miracle of the Sea, #202
4. Creatures of the Sea, #209
5. The Coral Reef, #208
6. Mighty Currents of the Sea, #216
7. Landscapes of the Sea, #217

Available from: National Academy of Sciences
National Research Council
Washington, D. C.

Understanding Our Deep Frontier. Committee On Oceanography, 1966.
9 film strips, 9 records, and guides.

8. Introduction to Oceanography
9. Physical Oceanography
10. Chemical Oceanography
11. Geological Oceanography
12. Biological Oceanography
13. Ocean Engineering
14. Marine Resources
15. Air-Sea Interaction
16. A Career in Oceanography

Available from: Scholastic Magazines
902 Sylvan Avenue
Englewood Cliffs, New Jersey 07632

17. Ocean Currents--Clues to Climate. #SF4. 1970. Filmstrip, guides.

Available from: Imperial Film Company, Inc.
The Executive Plaza
4404 S. Florida Avenue
Lakeland, Florida 33803

18. The Underwater Environment. 1970. 4 filmstrips, 4 records, guides.

SUGGESTED DISCUSSION QUESTIONS

1. Interpret and explain the following factors concerning phosphorescence in the sea: (1) origin; (2) appearance; (3) sources; (4) uses; (5) extent.
2. What are the areas of the sea that have the highest, median and lowest evaporation rates?
3. What is the importance of the evaporation rate to the hydrologic cycle?
4. Discuss the dependence on the exchange of energy between the oceans and the atmosphere.
5. Compare and contrast the continental slopes and the continental shelves.
6. Where are the red clay sediments found? The diatom oozes? How are these depositions similar? Different? Which type of sediment covers the largest area?
7. Where is the tsunami's origin and conclusion?
8. Could land masses continue to support their biological populations if all ocean current movement should suddenly cease? Why or why not?
9. How do ocean currents affect the biological ocean populations?
10. What effect do the moon and sun have upon ocean currents?
11. Of what importance are the coral reefs (both living and dead) that fringe land areas?
12. Describe the Coriolis effect and discuss its relationship to the differences in the density of sea water.
13. What are the pros and cons concerning the production of power from tidal sources?
14. Why do certain kinds of organisms grow in some parts of the ocean and not in others?
15. What is the average composition of sea water? Is the ocean getting saltier?
16. What is the role of the oceanographer as portrayed by the news media? Is this role compatible with the one that your studies have shown?

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Objectives	Texts	Labs	Projects	Reports	Field Trips	Demonstrations	Films	Transparencies	Discussion Questions	Film Strips	Problems	Models	References
1	#1 pp. 66-135 #3 Part II #5 Chap. II	3 2			2		26 27 13		7 13 14	9	1		#1 Chap. 8 #3 Chap. 1,7,15
2	#3 Part II #1 p. 142	2							7	9	2		1,7,13,15
3	#1 pp. 60-142 #3 pp. 126-138	4	1		7				8,10	6,9,17	5		6,7,11,12 #2 p. 27 #3 Ch. 8
4	#3 pp. 48-62				3	6	25		9	12,18			7,21 #2 p. 8 #3 Ch. 6
5	#3 pp. 79- 82, 173-183	5,6			5		32,33		15	10,18			7,23 #2 p. 11 #3 Ch. 7
6	#3 pp. 41-76, 124-182 #4 p. 133		2	4	3		24 32 33	2	5,6	7,11	4		5,7,9,17, 18,19 #3 Ch. 4,5
7	#3 pp. 23-55, 139-154 #4 Ch. 8	8,9, 15	6,8	2,6	7,8	4	8,16, 19,21, 30	1	8,11,14	3,4,12, 18		1,2,3, 5	20,21,22 #2 pp. 15-20 #3 Ch. 6
8	#3 Part I #3 pp. 22-35, 64-79, 159,173	1			5	1	28,32, 33		11,12, 14	13,18			7,16 #3 Ch. 6 #2 p. 20
9	#2 pp. 14-153 #5 pp. 11-215	7,10, 12	7		6,12	5	1,3,5, 6,22		14	18		6	2,7,14,26
10	#3 Part II	16		7	1				2,3,4	15,17			10,25 #3 Ch. 3 #2 pp. 22-40
11	#3 pp. 107, 124,184, 196		3				28		13	8,13			#2 pp. 30-40 #3 Ch. 9
12	#3 pp. 173-183	7	5			7	9			14			7,23 #3 Ch. 7
13	#2 pp. 9-153, #5 pp. 11-217	11,14	9	5	4,9, 10	3	2,4,7, 10,11, 12,14, 22			5		3,4, 6,7	2,7,14 #3 Ch. 4,6
14	#1 pp. 1-242	11,13, 14	10	1,3	11	2	15,18, 17,20, 23,24		1	1,2,12, 18	3	1,2,5	7,21,22 #3 Ch. 1
15	#3 pp. 51-53, 60,68,71, 142,109		4				29,31		16	8,16			2,4,7,8 #3 Ch. 10,2